Evaluation of Pesticide Supplies and Demand for 1977

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EVALUATION OF PESTICIDE SUPPLIES AND DEMAND FOR 1977. By Paul A. Andrilenas and Theodore R. Eichers, Economic Research Service, U.S. Department of Agriculture, Agricultural Economic Report No. 366.

ABSTRACT

Pesticide supplies for the 1977 crop season appear ample for all major uses. Production for 1977 is expected to be up about 10 percent. Supplies are up somewhat more, about 14 percent, because of larger inventories held by manufacturers and distributors than last year. Manufacturers and distributors reported that prices to dealers were up 6 percent or less and prices to growers were expected to be up 10 percent or less, with lower prices for some products in abundant supply. Demand is expected to be less than supply, leaving a net surplus of 5 to 10 percent. Supply estimates are based on surveys of pesticide manufacturers and distributors. Demand estimates are based on farmers' 1977 planting intentions and data on pesticide use patterns.

KEY WORDS: Pesticide production, pesticide supply, pesticide demand, pesticide prices, pesticide outlook.

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PREFACE

This is the third pesticide supply-demand evaluation report prepared by the Economic Research Service. It is prepared on an annual basis in response to the continuing need of manufacturers, distributors, growers and policymakers for comprehensive pesticide situation and outlook information.

The authors wish to express their appreciation to the pesticide producers and distributors who provided information for this study.

The use of trade names in this report is for identification only and does not constitute endorsement of such products or imply discrimination against other similar products.

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SUMMARY

With an expected 14-percent increase in pesticide supplies and only a 5 percent rise in expected demand (use), an overall surplus is anticipated for 1977 and demand for all major uses should be met.

Supply Outlook

Net pesticide supplies for the 1977 crop season are up about 14 percent because of increases in production as well as in manufacturer and distributor inventories.

Pesticide production is up an estimated 10 percent over 1976--production of herbicides is reported to be up 10 percent, insecticides 13 percent, and fungicides 2 percent.

Production facilities are operating at a somewhat lower rate of their full capacity this year--82 percent compared to 86 percent last year, because of a 16-percent overall capacity expansion. Herbicide production capacity expanded nearly one-fourth in 1976. This is bringing the herbicide production operating rate down from 91 percent of capacity last year to 83 percent for 1977. Operating rates for all other types of pesticides except insecticides are also down for 1977.

Inventory carryovers by manufacturers and distributors into the 1977 crop season were also larger than for 1976. Manufacturer beginning inventories as a proportion of sales were up an average of 5 percent and distributor inventories were up 1 percent.

Demand Outlook

Pesticide demand for 1977 is expected to be about 5 percent greater than in 1976, largely because farmers intend to plant more soybeans and cotton. Also, more intensive use is expected because farmers are applying more herbicide combinations and using reduced tillage practices. Low soil moisture in parts of the country has created some uncertainty, however, and could reduce pesticide demand if not replenished by planting time.

Herbicide demand is likely to rise about 5 percent for corn and soybeans and 14 percent for cotton, but remain steady for small grains.

Insecticide demand is expected to be up about 12 percent for cotton, up slightly for corn and stable for fruits and vegetables.

Pesticide price patterns reported by manufacturers and distributors were expected to be comparable to those in 1976. Most pesticide prices were reported to be unchanged to up slightly. Manufacturers' prices were up by 6 percent or less and distributors expected farm prices to advance 10 percent or less. For products in abundant supply, prices are likely to be down somewhat.

For 10 products reported by USDA for 1976, prices of eight advanced and two dropped from the previous year.

Early season sales programs were reported to be offering farmers substantial discounts off regular season prices. However, as of mid-February fewer farmers than normal were reported to be taking advantage of early season programs.

Pesticide regulations continue to play an important role in farm pesticide use. Of primary concern this year is the final implementation in October 1977 of the Federal Insecticide Fungicide Rodenticide Act (FIFRA) Amended. This means all pesticide products registered before 1972 must be reregistered and all "restricted use" pesticide applicators must be certified by October 1977.

Outlook to 1985

USDA projections for the United States for 1974 through 1985 indicate little change in insecticide and fungicide use and an annual increase of 5 to 6 percent in herbicide use. These projections assume greater use of reduced-tillage and pest-management practices, increased pest resistance, and greater use of pesticide combinations, particularly for herbicides.

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by

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INTRODUCTION

With hundreds of active chemicals and thousands of different formulations in use, the pesticide market is a complex and volatile one. Pesticide use is determined by farm commodities produced, pest populations, weather conditions, and a host of other factors. Government regulations also play an increasing role in pest control. This changing market requires continuously updated situation and outlook information.

This study analyzes pesticide production, the factors affecting pesticide supply and demand for the 1977 crop season, and the longer term outlook through 1985. The production and supply sections of this report are based on data obtained from 27 basic pesticide manufacturers which account for about two-thirds of the farm pesticides produced and from seven regional pesticide distributors which serve most of the United States. The demand sections are based on 1977 farmer planting intentions and available data on acres treated and rates of application.

PESTICIDE PRODUCTION AND SUPPLY

Pesticide production for 1977 is expected to increase about 10 percent over the 1976 level (table 1). The overall increase for last year was slightly more, about 12 percent. Output of all types of pesticides is greater than in 1976, with herbicides up 10 percent, insecticides up 13 percent, and fungicides up 2 percent.

Table 1--Estimated pesticide production, inventories, and prices for basic pesticide producers, 1976 and 1977 1/

Item	Fungicides	Herbicides	Insecticides	All pesticides
		Percent		
Production (expected 1977 as a percent of 1976)	102	110	113	110
Inventory carryover (percent of production):				
For 1977	26	9	16	14
For 1976	22	5	10	9
Prices received (percent of previous year):				
1977 (expected)	104	106	102	104
1976	105	106	105	106

1/ Based on a survey of 27 basic pesticide producers conducted in November and December 1976. Inventory data used 1976 as the base year for 1976 and 1977.

Manufacturers' and distributors' inventory carryovers for use in the 1977 crop season were also larger than they were for 1976. End-of-year manufacturers' inventories as a share of 1976 production were about 5 percent larger than they were in 1975. At the end of the 1976 season, manufacturers' inventories stood at 14 percent of 1976 production compared to a 9 percent carryover at the end of the 1975 season. Manufacturers' inventories at the end of 1976 were reported at 26 percent of production for fungicides, 16 percent for insecticides and 9 percent for herbicides. Distributor inventories at the start of the 1977 season were 9 percent of 1976 sales for fungicides, 12 percent for herbicides and 10 percent for insecticides (table 2). Distributor inventories as a percent of 1976 sales were up slightly--about 1 percent.

No manufacturers reported shortages of raw materials nor did distributors report any difficulty in obtaining pesticide supplies. Producers contacted in mid-February indicated that gas and other fuel shortages were not interfering with 1977 production schedules. In fact, both manufacturers and distributors indicated that abundant supplies of certain pesticides might result in lower prices. Normal cutbacks in planned production were, however, reported by a few manufacturers. One producer reported that high raw material prices caused him to reduce insecticide output. Also capacity limitations and poor scheduling caused a few producers to reduce their scheduled production.

Table 2--Selected indicators of pesticide supplies and demand at distributor level, 1975 to 1977 1/

Item	Fungicides	Herbicides	Insecticides	Other pesticides	All pesticides
			Percent		
Sales by type (1977)	7	70	19	4	100
Expected sales 1977 percent of 1976	114	110	113	109	111
Inventory carryover (percent of production) 2/					
For 1977	9	12	10	6	11
For 1976	8	10	11	4	10
Average rise in prices paid to suppliers:					
1976 to 1977	6	1	6	3	2
1975 to 1976	7	6	6	4	6
Estimated farm price as a percent of previous year:					
1977 percent of 1976	106	110	106	106	107
1976 percent of 1975	106	108	106	107	107

1/ Based on replies from seven regional farm supply distributors serving most of the Nation.

2/ Assumes that distributor sales were the same as production. Inventory data used 1976 production as the base year for both 1976 and 1977.

Capacity

Pesticide production capacity has increased substantially in the last 2 years, following several years of limited growth. Basic pesticide production capacity for 1977 is reported to have risen 16 percent over last year. The rate of facility construction exceeded anticipated production increases for 1977. Production is expected to rise only 10 percent. Therefore, facilities are operating at a lower rate of capacity than in 1976--82 percent for 1977 compared to 86 percent for 1976 (table 3). These additions are permitting producers some flexibility for down-time to repair and modify their plants.

Herbicide capacity for 1977 is up nearly one-fourth, following a 20 percent increase last year. As a result, herbicide production facilities are

operating at 83 percent of capacity for 1977 compared to 91 percent last year and 92 percent in 1975. On the other hand, insecticide facility expansion for 1977 did not keep pace with planned output. Plant additions for 1977 increased insecticide capacity by only 8 percent while production is expected to rise about 13 percent. Thus, insecticide plants are operating at 88 percent of capacity, compared with 85 percent last year. New facilities for producing fungicides added about 12 percent to fungicide production capacity and reduced the operating rate from 82 percent of capacity in 1976 to 75 percent for 1977.

Table 3--Pesticide production capacity utilization in 1976, expected 1977, and expansion plans for 1977 1/

Type of pesticide	Production as a percentage of capacity		Capacity expansion plans, percentage change, 1976 to 1977
	1976	Expected 1977	
	Percent		
Fungicides	82	75	12
Herbicides	91	83	23
Insecticides	85	88	8
All pesticides	86	82	16

1/ Based on a survey of 27 basic pesticide producers conducted in November and December 1976.

Prices

Pesticide prices for 1977 appear to be following last year's patterns with modest advances and a few declines. Manufacturers were reporting expected price advances of 6 percent or less. Distributors were expecting farm price increases to be 10 percent or less. Price expectations were reported to be similar for all types of pesticides, with prices of specific products in abundant supply somewhat lower. This is especially likely to be true for certain herbicides. These products reflect the combined effects of increased production and depressed demand due to drought conditions in large sections of

the Nation. Also early season sales programs have been offering farmers pesticides at substantial discounts. However, as of mid-February, distributors were reporting that fewer farmers than normal were taking advantage of early season programs.

For 10 leading pesticide products reported by the U.S. Department of Agriculture, the price of two dropped about 8 percent, six increased from 1 to 6 percent and two rose more than 10 percent from 1975 to 1976 (table 4). The average price rise for the 10 products was less than 4 percent, compared with an average price rise of over 50 percent in the preceding 2-year period.

Net pesticide supplies

The combination of increased pesticide production and larger inventories is likely to produce a 14-percent overall pesticide net supply increase. Herbicide and insecticide supplies show increases of 14 to 15 percent and fungicide supplies are up 5 percent.

DEMAND

Demand for pesticides is expected to increase somewhat in 1977 due to planned increases in cotton and soybean acreage and more intensive pesticide use.1/ January farmer planting intentions indicated that cotton and soybean acreage would rise 10 percent and 6 percent, respectively, over last year. Corn acreage is also likely to increase slightly, about 0.5 percent. However, some acreage decreases are anticipated, with total wheat acreage for 1977 down 7 percent and intended sorghum acreage down 8 percent from last year. These decreases are partially offset by expected increases in oats and barley acreage. As a result total demand for pesticides in 1977 is likely to be up about 5 percent over last year's levels. Low soil moisture in parts of the country was creating some uncertainty and could reduce pesticide demand if it is not replenished by planting time.

Pesticide Supply-Demand Balance

Herbicides

Herbicides have been the major component in the increasing pesticide use of recent years. However, a high proportion of the major crop acres are now treated with herbicides and demand is leveling off. This, coupled with drouth conditions in many sections of the country, has dampened the demand for some herbicides. However, other factors have increased the demand for herbicides: more broadcast versus band applications and greater use of herbicide combinations. Increases in expected overall herbicide supplies exceed projected demand increases by about 9 percent.

1/ In this report demand is used in the industry context of use, rather than the economic context of quantities taken at different prices.

Table 4--Average prices paid by farmers for selected pesticides as reported by USDA, 1974 to 1976

Pesticide product 1/	Price per pound of active ingredient			Price rise	
	1974	1975	1976	1974 to 1975	1975 to 1976
	Dollars			Percent	
Insecticides:					
Aldrin	2.00	2.30	2.35	15	2
Carbaryl	1.38	1.74	2.16	26	24
Malathion	2.14	2.70	2.86	26	6
Methyl parathion	1.64	2.55	2.34	55	-8
Parathion	1.88	2.58	2.65	37	3
Toxaphene	.76	.97	.98	28	1
Average	2/	--	--	31	4
Herbicides:					
Atrazine	2.92	3.69	3.40	26	-8
2,4-D	1.46	2.43	2.53	66	4
2,4,5-T	3.15	4.30	4.38	37	2
Average	--	--	--	43	-1
Fungicides:					
Zineb	1.08	1.51	1.68	40	11

Source: Agricultural Prices, Stat. Rpt. Serv., U.S. Dept. Agr., Pr 1 (6-76), June 1976, and earlier issues.

1/ Aldrin, 4 pounds per gallon emulsifiable concentrate; carbaryl, 80 percent wettable powder; malathion, 5 pounds per gallon emulsifiable concentrate; methyl parathion, 4 pounds per gallon emulsifiable concentrate; parathion, 4 pounds per gallon emulsifiable concentrate; toxaphene, 6 pounds per gallon emulsifiable concentrate; atrazine, 80 percent wettable powder; 2,4-D, 4 pounds per gallon emulsifiable concentrate; 2,4,5-T, 4 pounds per gallon emulsifiable concentrate; zineb, 75 percent wettable powder.

2/ Blanks indicate data not available.

Corn and soybean herbicide demand for 1977 is expected to rise about 5 percent over 1976, primarily because of an anticipated increase in soybean acreage (table 5). Corn acreage is expected to be almost unchanged, increasing less than 1 percent.

Net corn and soybean herbicide supplies are likely to exceed demand as a result of increases in production and manufacturer and distributor inventories. Therefore, supplies of corn and soybean herbicides should be adequate and distributors and producers will probably end the season with larger inventories than last year.

Table 5--Supply-demand balance for pesticides used by farmers, 1977

Type of pesticide and crop	Percentage change from 1976 to 1977	
	Demand 1/	Net supply 2/
	Percent	
Herbicides:		
Corn and soybeans	+5	3/ __
Cotton	+14	__
Small grains 4/	0	__
All herbicides	+6	+15
Insecticides:		
Corn	+2	__
Cotton	+12	__
All insecticides	+4	+14
Fungicides	0	+5

1/ Based on 1977 farmer planting intentions as reported in "Prospective Plantings", Stat. Rpt. Serv., U.S. Dept. Agr., CrPr 2-4, (1-77), and on current application rates.
2/ Based on November-December 1976 survey of 27 basic pesticide producers.
3/ Blanks indicate data not available.
4/ Includes all wheat, oats, and barley.

Anticipated increased plantings are likely to result in a 14-percent rise in the demand for cotton herbicides. However, increased supplies should be ample to meet cotton growers' requirements.

More intensive pesticide use is expected to offset reduced small grain acreage and herbicide demand for these crops is not likely to change noticeably. Net supplies of small grain herbicides are up, so small grain growers should have few problems in obtaining the herbicides they need.

Insecticides

Insecticide demand is expected to be up slightly in 1977, largely because of increased cotton acreage. The proportion of acres treated and the intensity of use have not shown any marked trends in recent years. However, a general increase in the number of applications may be attributed to a continuing shift from persistent organochlorine insecticides to the less persistent organophosphates. The projected overall insecticide supply increase for 1977 exceeds the projected demand increase by about 10 percent.

Corn insecticide demand is likely to be unchanged to up slightly. Again, supplies of corn insecticides should be adequate. Distributors reported that farmers were having some difficulty controlling certain soil insects, particularly cutworms, since the use of aldrin was discontinued. Chlordane and heptachlor have been used in place of aldrin, but these products will also not be available for the 1977 season. The loss of these materials will require the use of more substitute materials and could result in some yield losses.

Although the demand for cotton insecticides is expected to be up about 12 percent over last year, anticipated cotton insecticide supplies should be ample to meet this demand. The removal of chlordimeform from the market at the end of the 1976 season is causing some cotton growers serious concern in controlling the tobacco budworm. If effective substitutes are not available for the 1977 season, substantial losses could occur in susceptible areas covering a major share of the Cotton Belt. Without chlordimeform or new substitute materials, growers will need to rely on better management techniques. These would include more scouting and well planned early-season spray programs. In addition, greater late-season use of currently available materials such as methyl parathion, toxaphene, methomyl, and chlorpyrifos may be required.

The use of other insecticides is expected to be unchanged or to increase slightly as acreage of the other major uses (fruits and vegetables) is fairly constant from year to year. Supplies of other insecticides should be sufficient.

Fungicides and other pesticides

Demand for fungicides, used primarily on fruits and vegetables, should be unchanged or increase only slightly. Demand for other pesticides is likely to

rise about 5 percent, largely because of increased cotton plantings and an anticipated increase in the use of defoliants and dessicants. Supplies of fungicides and other pesticides should also be sufficient.

Pesticides Used

The farm pesticide market is comprised of hundreds of different chemical products. New products are constantly being introduced and existing products are being phased out. This section of the report evaluates the current status of the market by identifying leading sales products and those suffering substantial losses.

The leading herbicide product sold in 1976 by the distributors contacted for this study was atrazine. All but one of the distributors reported that atrazine was either the highest or the second highest ranking herbicide sales item. Alachlor was the second-ranking herbicide sales product. All but one distributor reported sales of alachlor among their top three herbicide products. Other herbicides cited among the three leading products by some distributors were 2,4-D, trifluralin, butylate, benefin, and simazine.

Carbofuran was cited as the leading insecticide sold by nearly 60 percent of the distributors contacted. Carbaryl was reported among the top three insecticides by the same number of firms as carbofuran. Other products reported among the three leading insecticides were terbufos, azinphosmethyl, phorate, methyl parathion, toxaphene, methomyl, diazinon, and disulfoton.

Sales dropped sharply for chlordane and chlordimeform. Chlordane was discontinued by regulatory action and the manufacturer of chlordimeform took it off the market because of its possible health hazards. Lower sales of trifluralin reflected reduced soybean acreage and unfavorable weather. Methyl parathion and paraquat sales were also reported to be down somewhat because of price and other factors.

Pesticide Regulations

Major pesticide regulatory activities of concern to farmers are reregistration of currently registered pesticide products, certification of applicators that intend to apply "restricted use" pesticides and cancellation and suspension rulings concerning specific pesticide products. Both the pesticide reregistration classification and applicator certification activities are mandated for completion by October 1977.

All pesticides registered before 1972 must be reregistered by October 1977 to meet the requirements of the current pesticide control act--FIFRA Amended. For pesticides not satisfying the risk requirements for reregistration, EPA will issue a Rebuttable Presumption Against Registration (RPAR). This presumption may be rebutted by the applicant either by showing that EPA erred in determining that the RPAR exists or that the risk can be reduced (through labeling, packaging, use restrictions, etc.) so that significant adverse effects are not likely to occur, or that the benefits are likely to exceed the

risks. If the presumption against registration is not successfully rebutted EPA may issue a notice of intent to cancel. In this case the applicant may request a hearing. EPA may also hold hearings to determine whether to cancel or reclassify the product.

By October 1977, all persons intending to apply restricted use pesticides must be certified. An official list of restricted use pesticides has not yet been issued, but a preliminary list includes 81 products. Highly toxic materials such as the parathions are certain to be included in the final list.

Two clases of certification are being granted, commercial and private. Commercial certification is for custom applicators and private certification is for individuals, for which most farmers are expected to qualify. Private applicators can become certified by demonstrating competence in using pesticides, usually by attending a pesticide applicator training session. Federal rules do not require the private applicator to pass an examination, but individual States may.

In addition to these activities, continuing litigation occurs with respect to suspension and cancellation of specific pesticides. Currently two litigative actions are in process. Chlordane and heptachlor are in the cancellation hearing process and the decision to phase out the use of mirex bait for fire ant control in 1978 has been appealed.

On December 24, 1975, EPA suspended the production of chlordane and heptachlor for most uses. The ruling permitted continued use of chlordane for controlling underground termites, fire ants, and Japanese beetles in specified quarantine programs. Several other uses were allowed in some localities as well. Use on corn was also permitted until August 1, 1976. But unless the cancellation hearing currently in process issues a different ruling, the 1975 suspension decision continues in effect and these products will not be available for use on corn this year.

Recently the EPA and the State of Mississippi entered an agreement whereby Mississippi would produce mirex bait for the fire ant control program, the production and use of which would be phased out over a 2-year period. Aerial application would be phased out by the end of 1977 and ground application by June 30, 1978. This decision has been appealed by two parties.

WORLD PESTICIDE USE AND OUTLOOK

World pesticide use and outlook must be considered separately for the developed and the developing nations.

The developed nations use about three-fourths of the world pesticide output, yet they account for less than one-third of the world population. The developed nations apply pesticides at nearly 10 times the rate per acre used in the developing nations (1).2/ Although the pesticide growth rate for the

2/ Underscored numbers in parenthesis refer to references cited at the end of this report.

next several years in the developing nations is projected at twice that for the developed nations, the latter are still expected to account for over 70 percent of world pesticide use by 1980 (3).

In the developed nations diets are generally adequate and intensive pesticide use is in some cases posing undesirable side effects to the environment and to handlers and consumers. As a result, many of the developed nations have undertaken measures to restrict the use of certain potentially harmful pesticides and to assure proper handling and application. For example, the United States discontinued the use of DDT and a number of other organochlorine insecticides. Other developed nations also have active programs to monitor and regulate the use of pesticides. This trend toward closer regulation of pesticides is expected to continue in the developed nations, many of which are actively searching for nonchemical methods of pest control. But for the near future, pesticides will continue to play a major role.

The developing nations are still generally suffering from poor diets and frequently from vector-borne diseases. Often insects and plant diseases almost completely destroy many of their crops. For example, one disease (black pod) was reported to have destroyed up to 90 percent of Nigeria's cocoa crop (5). Further, 40 percent of Asia's rice crop and an estimated third of Latin America's total crop potential is lost to insects, diseases and weeds each year (5). Thus, in most of the developing nations, the benefits of increased pesticide use will probably exceed the risks for some time to come.

The developing nations use mostly insecticides and fungicides. These two types of materials accounted for about 90 percent of all of their 1971 pesticide use (4). Herbicides accounted for less than 10 percent of all pesticides used, and for the foreseeable future, increased use of pesticides in the developing nations will be seen largely in insecticides and fungicides. Abundant labor supplies and a shortage of capital will preclude any substantial increase in the use of herbicides except for unique weed problems that can only be controlled with chemicals, or for use by large commercial producers.

The developing nations rely mostly on the developed nations for their pesticides. FAO estimates indicated that slightly over half of the pesticides used in the developing nations were imported in the early seventies (4). This share was expected to increase to about 60 percent by the late seventies because of greater use of more complex pesticide chemicals. Domestic production in the developing nations is confined largely to formulation. The developed nations produce most of the basic pesticide chemicals.

UNITED STATES OUTLOOK TO 1985

A USDA study indicates that the future growth rate of agricultural pesticide use in the United States will be slower than in recent years (2). With a moderate demand for agricultural products the growth rate from 1974 through 1985 is projected at 3 percent a year. With a high demand it is projected at 4 percent a year. Small increases (about 1 percent) were projected for

insecticide and fungicide use, but herbicide use was expected to increase 5 to 6 percent a year.

An industry study projected an annual increase in pesticide sales from 1974 to 1980 of about 6 to 7 percent (3). By comparison, the growth in pesticide production was 5 percent a year from 1969 to 1974 and 8 percent a year from 1964 to 1969.

The USDA 1985 projections assume greater use of reduced tillage and pest management practices, increased regulation and somewhat more resistance problems. For insecticides and fungicides, 1985 use levels were expected to be comparable to those in the mid seventies. Some growth was expected to occur in the early years. But as pest management programs are used more widely and effectively, and nonchemical control methods are introduced, use of these products is expected to level off or even decline.

The study assumed that the proportion of acres treated for disease control would increase over time for many crops because reduced tillage may result in more disease problems. Fungicide increases were projected for soybeans, peanuts, cotton, sugarbeets and potatoes. The proportion of fruit and vegetable acreage (other than potatoes) treated would remain at recent levels. The quantity of fungicides used per acre was generally reduced over time to reflect fewer applications associated with improved pesticide management practices. Application rates were held constant over time. The study assumed the use of smaller amounts of fungicides per acre for peanuts, tobacco, potatoes, other vegetables and fruit.

The study also assumed that the percentage of acres treated for insect control would continue to increase as in recent years. And, this increase was accelerated for the crops where reduced tillage was expected to increase. The quantity per acre for all applications was reduced on the acreages where better pest management practices suggested that fewer sprays would be needed. The number of sprays was assumed to be reduced over time on most crops other than small grains and hay.

It was assumed that the proportion of acres treated for weed control would continue to increase over time as it had in recent years. This would be most apparent, at least initially, for row crops because more acres would require herbicide treatment due to the shift to reduced tillage. The quantity per acre would increase over time because of the increased use of herbicide combinations rather than single herbicides. Also, the quantity per acre would increase on many of the acres where reduced tillage practices would be used. With reduced tillage, up to 40 percent more herbicides are used per acre, primarily because the herbicides are broadcast rather than banded.

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